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(54) THREE-DIMENSIONAL NOISE REDUCTION DEVICE AND OPTICAL DISK  
REPRODUCING DEVICE USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a three-dimensional(3D) noise reduction device capable of applying an optimum filter characteristics to video information by using the variable transfer rate value or the like of video information stored in a reproducing disk specific for a DVD or an MPEG picture data obtained at MPEG decoding as a parameter when applying a digital video disk is subjected to the 3D noise reduction device.

SOLUTION: This three-dimensional noise reduction device is provided with a determination function 57 for determining the characteristics of a digital filter based on a film camera mode to be management information obtained from a medium for storing digital compressed data including video information and a noise reduction circuit 53 for reducing the noise of the video information obtained

from the medium in a vertical (V) direction a horizontal (H) direction and a time direction based on the determined digital filter characteristics and the device is used for an optical disk reproducing device.

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## CLAIMS

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[Claim(s)]

[Claim 1] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on a film camera mode which is the management information obtained from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 2] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter in order to incorporate film camera mode information acquired from an optical disc which stores digital compressed data including video information to weaken an effect of a digital filter at the time of a film mode and to strengthen an effect of a digital filter at the time of a camera mode.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 3] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on the bit rate of video information which is the management information obtained

from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 4] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter in order to weaken an effect of a digital filter at the time of a high rate and to strengthen an effect of a digital filter based on the bit rate of video information which is the management information obtained from an optical disc which stores digital compressed data including video information at the time of a low rate.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 5] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on the bit rate and a film camera mode of video information which are the management information obtained from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 6] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on

video compression mode which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 7] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on TV system mode which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 8] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on an aspect ratio which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 9] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on

a display mode which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 10] A three-dimensional noise reduction circuit comprising:

A determination means to determine the characteristic of a digital filter based on source picture resolution which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[Claim 11] An optical disk reproducing device comprising:

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter based on a film camera mode which is the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[Claim 12]An optical disk reproducing device comprising:

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter in order incorporate film camera mode information which is the management information obtained from said optical disc to weaken an effect of a digital filter at the time of a film mode and to strengthen an effect of a digital filter at the time of a camera mode.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[Claim 13]An optical disk reproducing device comprising:

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter based on the bit rate of said video information which is the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[Claim 14]An optical disk reproducing device comprising:

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter in order to weaken an effect of a digital filter at the time of a high rate and to strengthen an effect of a digital filter based on a film camera mode which is the management information obtained from said optical disc at the time of a low rate.

Based on the characteristic of a digital filter determined by said determination means an effect of a digital filter is weakened at the time of a high rate. A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means in order to strengthen an effect of a digital filter at the time of a low rate.

[Claim 15] An optical disk reproducing device comprising:

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter based on the bit rate and a film camera mode of video information which are the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention is a three-dimensional noise reduction device and relates to the three-dimensional noise reduction device used especially for a DVD device.

[0002]

[Description of the Prior Art] the conventional compact disk for audios as these days and an optical disk (it is hereafter described as CD) -- in addition a digital videodisc and its playback equipment are developed. Also in this digital videodisc it is a size of the same grade as the conventional CD (12 cm in diameter) and the movie information for about 2 hours is recorded and the refreshable disk is developed especially these days. In addition to movie information in this digital videodisc the format which can record the caption data of the sound of eight kinds of different languages or music and 32 kinds of different languages on the same disk is considered.

[0003] In such a digital videodisc after video information finishes decoding about MPEG for example noise reduction processing is performed and noise mitigation suitable about video information is performed.

[0004] However since the grade of this noise reduction is not uniformly performed with the set-up value and the grade of noise reduction according to a parameter peculiar to DVD is not necessarily set up fine noise reduction is not necessarily made.

[0005]

[Problem(s) to be Solved by the Invention] Therefore the conventional noise reduction is uniformly performed to an image by a fixed grade and has the problem that a suitable value is not given in consideration of each parameter peculiar to DVD.

[0006] It is determining the grade of filter characteristics according to the



parameter of the image each time so that optimal noise reduction may be performed to the image in consideration of a parameter peculiar to DVD so that this invention may solve the above-mentioned technical problem. It aims at providing the optical disk reproducing device using the three-dimensional noise reduction circuit and this which realize reproduction of a good image.

[0007]

[Means for Solving the Problem] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on a film camera mode which is the management information obtained from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0008] By the above-mentioned structure this invention makes a grade of a digital filter change automatically by a high film mode of grade of an image or low camera mode-ization and is set up. Thereby a three-dimensional noise reduction circuit which can perform optimal filtering according to grade of an image can be provided.

[0009] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter in order incorporate film camera mode information acquired from an optical disc which stores digital compressed data including video information to weaken an effect of a digital filter at the time of a film mode and to strengthen an effect of a digital filter at the time of a camera mode.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video

information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0010] Thereby according to this invention weak filtering enables it to pull up an image to a constant level by strong filtering at a high-definition film mode at a camera mode of a low grade taking advantage of an original image.

[0011] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on the bit rate of video information which is the management information obtained from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0012] Thereby this invention becomes possible [ setting up a grade of filtering automatically ] according to the bit rate which influences grade of an image.

[0013] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter in order to weaken an effect of a digital filter at the time of a high rate and to strengthen an effect of a digital filter based on the bit rate of video information which is the management information obtained from an optical disc which stores digital compressed data including video information at the time of a low rate.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0014]A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on the bit rate and a film camera mode of video information which are the management information obtained from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of Vthe direction of Hand a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0015]Therebynot only according to a parameter of a simple substance but according to two or more parameters (the bit rate and film camera mode)this invention determines a grade of filtering and realizes reproduction of more nearly optimal image.

[0016]A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on video compression mode which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of Vthe direction of Hand a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0017]Therebythis invention can give a grade of optimal filtering over MPEG 2 peculiar to DVD in consideration of video compression mode.

[0018]A three-dimensional noise reduction circuit this invention is characterized

by that comprises the following.

A determination means to determine the characteristic of a digital filter based on TV system mode which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0019] This invention also makes a decision of filter characteristics about TV system mode further.

[0020] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on an aspect ratio which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0021] Thereby this invention also makes a decision of filter characteristics about an aspect ratio further.

[0022] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on a display mode which is the management information of video information acquired from an optical disc which stores digital compressed data including

video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0023] Thereby this invention also makes a decision of filter characteristics about a display mode further.

[0024] A three-dimensional noise reduction circuit this invention is characterized by that comprises the following.

A determination means to determine the characteristic of a digital filter based on source picture resolution which is the management information of video information acquired from an optical disc which stores digital compressed data including video information.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said video information acquired from said optical disc based on the characteristic of a digital filter determined by said determination means.

[0025] Thereby this invention also makes a decision of filter characteristics about source picture resolution further.

[0026] An optical disk reproducing device this invention is characterized by that comprises the following.

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter based on a film camera mode which is the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[0027] This invention provides an optical disk reproducing device using the above-mentioned noise reduction circuit. Thereby optimal filtering according to an image can reproduce a high definition image given automatically with the same meaning.

[0028] An optical disk reproducing device this invention is characterized by that comprises the following.

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter in order incorporate film camera mode information which is the management information obtained from said optical disc to weaken an effect of a digital filter at the time of a film mode and to strengthen an effect of a digital filter at the time of a camera mode.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[0029] An optical disk reproducing device this invention is characterized by that comprises the following.

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains

decoding picture image data.

A determination means to determine the characteristic of a digital filter based on the bit rate of said video information which is the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[0030]An optical disk reproducing device this invention is characterized by that comprises the following.

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter in order to weaken an effect of a digital filter at the time of a high rate and to strengthen an effect of a digital filter based on a film camera mode which is the management information obtained from said optical disc at the time of a low rate.

Based on the characteristic of a digital filter determined by said determination means an effect of a digital filter is weakened at the time of a high rate. A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means in order to strengthen an effect of a digital filter at the time of a low rate.

[0031]An optical disk reproducing device this invention is characterized by that comprises the following.

An extraction means which picks out digital compressed data from an optical disc which stores digital compressed data including video information.

A decode means which decodes said digital compressed data and obtains decoding picture image data.

A determination means to determine the characteristic of a digital filter based on the bit rate and a film camera mode of video information which are the management information obtained from said optical disc.

A noise reduction means to perform processing which makes a noise reduce about the direction of V the direction of H and a time direction about said decoding picture image data obtained from said decode means based on the characteristic of a digital filter determined by said determination means.

[0032]as mentioned above -- also in a DVD reproducer optimal filter characteristics according to a kind of image give automatically by using a three-dimensional noise reduction circuit of this invention -- \*\*\*\* -- a high definition image is realizable by things.

[0033]

[Embodiment of the Invention] Hereafter the optical disk reproducing device applied to this invention with reference to drawings and its three-dimensional noise reduction circuit are explained in detail below.

[0034]Drawing 1 shows the optical disk reproducing device concerning this embodiment of the invention. The optical disk reproducing device 1 with which this image restoration system plays data from an optical disc It is constituted by the final controlling element 2 which directs operation of this image display whole system the display part 4 which displays the image reproduced by the optical disk reproducing device 1 and the audio part 5 which generates the sound reproduced by the optical disk reproducing device 1.

[0035]In drawing 1 the optical disc (DVD) 10 as a recording medium is laid on a turntable (not shown) is clamped by the clamper and is rotated by the motor 11. Now supposing it is reproduction mode the information recorded on the optical disc 10 will be taken up by the pickup part 12. the pickup part 12 -- the servo section 13 -- the movement controls to a disk radial and focus control -- tracking



control is carried out. The servo section 13 sends a control signal also to the disk motor actuator 14 and is performing the roll control of rotation (that is optical disc 10) of the motor 11.

[0036] The output of the pickup part 12 is inputted into a recovery / error correction part 15 and it restores to it. The demodulated data to which it restored here is inputted into the demultiplexer 17 via the buffer 16. Demodulated data is inputted into the DSI decoder 19 via the input buffer 18. Decoded DSI (data search information) is sent to the system control part 30. Demodulated data is sent to the system control part 30 via the system buffer 20. As data taken into the system control part 30 through this system buffer 20 there are management information etc. for example.

[0037] Separation of each pack is performed in the demultiplexer 17.

[0038] Via the buffer 21 the video pack (VPCK) taken out from the demultiplexer 17 is inputted into the video decoder 22 and is decoded. The video signal (main video signal) outputted from the video decoder 22 is inputted into the image reproduction part 23.

[0039] Via the buffer 24 the sub picture pack (SPPCK) taken out from the demultiplexer 17 is inputted into the sub picture decoder 25 and is decoded. The sub picture (sub video signal) outputted from the sub picture decoder 25 is inputted into the image reproduction part 23.

[0040] Via the buffer 28 the PCI pack taken out from the demultiplexer 17 is inputted into the PCI decoder 29 and is decoded. The output of the PCI decoder 29 is inputted into the system control part 30 and the image reproduction part 23.

[0041] In the image reproduction part 23 the video signal which the sub picture from the sub picture decoder 25 superimposed from the video decoder 22 to the main video signal is obtained by this. The 2nd emphasis value of the picture element data from the sub picture decoder 25, the 1st emphasis value or the 2nd emphasis value, the coordinate value of the highlight information from the PCI decoder 29, the contrast value of highlight information, the video signal based on the color code value of highlight information, the coordinate value of the display

commands from the sub picture decoder 25 the contrast value of display command the color code value of display command etc. is obtained. The video signal from this image reproduction part 23 is supplied to the display part 4.

[0042] Via the buffer 26 the audio pack (APCK) taken out from the demultiplexer 17 is inputted into the audio decoder 27 and is decoded. The output of the audio decoder 27 is supplied to the audio parts 5 such as a loudspeaker.

[0043] In the demultiplexer 17 main video image information sub picture (title and character) information speech information control information etc. are separated and derived -- things -- \*\* That is it is because sub picture (title and character) information speech information management information control information etc. are recorded on the optical disc 10 corresponding to video information.

[0044] In this case as the title and the text and speech information which are sub picture information various kinds of languages can be chosen and this is chosen according to control of the system control part 30. To the system control part 30 the operational input by a user is given through the final controlling element 2.

[0045] Therefore decoding corresponding to the method of the display is performed in the video decoder 22 which decodes main video image information. For example the conversion process of the main video image information is carried out to NTSC PAL SECAM a wide screen etc. The audio information of the stream specified by the user will be inputted and decoded by the audio decoder 27. The sub picture data of the stream specified by the user is inputted into the sub picture decoder 25 and a sub picture is also decoded.

[0046] Next it attaches and explains to the format of the optical disk reproducing device and optical disc in which this invention was applied.

[0047] The record data structure of the optical disc 10 of this invention is explained. This optical disc 10 is a double-sided lamination disk which has a storage capacity of about 5 G bytes of one side for example and many recording tracks are arranged from read in area by the side of the inner circumference of the optical disc 10 before read out area by the side of the periphery of the optical disc 10. Each track comprises many logical sectors and the variety of information

(digital data compressed suitably) is stored in each sector.

[0048]Drawing 2 shows the BORIUMU space of the optical disc 10.

[0049]As shown in drawing 2 BORIUMU space consists of BORIUMU and a file organization zone a DVD video zone and other zones. UDF bridge composition is described by BORIUMU and the file organization zone and the data can be read now also by computer of a predetermined standard in them. A DVD video zone has a video manager (VMG) and a video title set (VTS). The video manager (VMG) and the video title set (VTS) comprise two or more files respectively. A video manager (VMG) is the information for controlling a video title set (VTS).

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The block diagram showing the composition of the optical disk reproducing device concerning this embodiment of the invention.

[Drawing 2]The explanatory view of the BORIUMU space which is the logical format currently recorded on the optical disc.

[Drawing 3]The explanatory view showing the structure of the video manager (VMG) who can set BORIUMU space and a video title set (VTS).

[Drawing 4]The explanatory view showing the contents of cell (Cell) with a video object set (VOBS) and the relation of cell (Cell) further.

[Drawing 5]The explanatory view showing the relation between a video object and a cell.

[Drawing 6]The explanatory view showing the example by which the cell (Cells) has the reproduction sequence controlled by the program chain (PGC).

[Drawing 7]The explanatory view of the video title set information (VTSI) in a video title set (VTS).

[Drawing 8]The figure showing the example of composition of one pack and packet.

[Drawing 9]The figure showing video title set information management table VTSI.

[Drawing 10]The flow chart which shows the menu reproduction motion of an optical disk reproducing device.

[Drawing 11]The flow chart which shows the title reproduction motion of an optical disk reproducing device.

[Drawing 12]The figure showing the control system of the three-dimensional noise reduction circuit of this invention.

[Drawing 13]The graph which shows the relation between an MPEG mode and the screen effect.

[Drawing 14]The graph which shows the relation between a camera mode film mode and the screen effect.

[Drawing 15]The figure showing a three-dimensional noise reduction circuit.

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